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REMARKS

The Examiner is thanked for his thorough examination of the present application. By this amendment, Claims 12-31 have been cancelled and new Claims 32-39 have been added to more clearly define the invention over the cited prior art references. Accordingly, favorable reconsideration is requested in view of the arguments present below.

I.   The Drawings

Regarding the Examiner's objection to the drawings, Applicants point out that the method of the present invention is described on pages 7-11 of the specification with reference to Figs. 1(B), 1(C) and 2. Further illustration of the method, i.e. a flowchart without any structural details, is not essential for a proper understanding of the invention. Accordingly, Applicants believe that the drawings comply with the requirements of 37 CFR 1.83 and the objection should be withdrawn.

II.   The New Claims

Each of the new independent Claims 32 and 36 includes resetting and immediately reading a preliminary output from each pixel, reading a first output from each pixel after a first period of time since a prior reset, the first output representing a cumulative signal during the first period of time since the prior reset, and reading a second output from each pixel after a second period of time since the prior reset and overlapping the first period of time and without resetting each pixel, the second output representing a cumulative signal during the second period of time since the

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prior reset and overlapping the first period of time.
Furthermore, a difference between the preliminary output and
each of the first and second outputs is determined to obtain
respective first and second sets of image data substantially
free of noise components represented by the preliminary
outputs and having first and second dynamic ranges, and the
first and second sets of image data are combined to obtain a
resultant set of image data having a dynamic range different
from the first and second dynamic ranges.

III.   The Claims Are Patentable

        Claims 12-31 were rejected in view of Yadid-Pechet
et al. (U.S. 6,115,065) or Hurwitz (U.S. 6,067,113) taken
individually or in various combinations with Dierickx (EP
0858212) for the reasons set forth on pages 3-11 of the Office
Action. Applicants contend that new Claims 32-39 clearly
define over the cited references, and in view of the following
remarks, favorable reconsideration of the rejections under 35
U.S.C. §102 and §103 is requested.
        As discussed above, each of the independent claims
includes resetting and immediately reading a preliminary
output from each pixel, reading a first output from each pixel
after a first period of time since a prior reset, the first
output representing a cumulative signal during the first
period of time since the prior reset, and reading a second
output from each pixel after a second period of time since the
prior reset and overlapping the first period of time and
without resetting each pixel, the second output representing a
cumulative signal during the second period of time since the
prior reset and overlapping the first period of time.

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Furthermore, a difference between the preliminary outputs and
each of the first and second outputs is determined to obtain
respective first and second sets of image data substantially
free of noise components represented by the preliminary
outputs and having first and second dynamic ranges, and the
first and second sets of image data are combined to obtain a
resultant set of image data having a dynamic range different
from the first and second dynamic ranges.

It is these combinations of features which are not
fairly taught or suggested in the cited references and which
patentably define over the cited references.

The Yadid-Pecht et al. patent addresses the same
problem as the present invention, namely achieving a greater
dynamic range, and does use an approach including reading each
pixel at two or more points in time after the frame reset to
obtain two exposures, and then using the appropriate exposure
for each pixel in the final output. The Yadid-Pecht et al.
reference discloses two broad ways of doing this.

In the first, each pixel is read at a first time T1
after initial reset. The read operation resets the pixel. The
pixel is read a second time T2 after the first read. The
presence of these two reads is used to compensate for noise.

In the second method of Yadid-Pecht et al., the
pixel is read at a first time T1 in a non-destructive manner,
i.e. without resetting the pixel. The pixel is read again at a
second time T2 after the first read, effectively giving an
exposure period extending from the initial frame reset to T2.
However, Yadid-Pecht et al. does not provide any noise
correction in this second method, and indeed appears to
consider that this is not possible. Applicants note column 7

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at lines 32-40 of Yadid-Pecht et al.: "One advantage of the
destructive readout is that correlated double sampling can be
implemented…" and "One advantage of the non-destructive
readout is that a fewer number of rows are needed…". In other
words, these approaches are presented as being mutually
exclusive.

In the independent claims as now presented, the
invention requires:

-reset;

-immediately reading to obtain a preliminary output;

-reading at time T1 to obtain a first output;

-reading at time T2 to obtain a second output;

-obtaining a first image by subtracting the
preliminary output from first output;

-obtaining a second image by subtracting the
preliminary output from second output; and

-combining pixels from first and second images to
obtain a final image with increased dynamic range.

This is clearly distinguished from the teachings of
Yadid-Pecht et al. which does not contemplate a preliminary
readout immediately following reset. Moreover, it would not be
obvious to one of ordinary skill in the art to modify Yadid-
Pecht in order to achieve the present invention because the
first method of Yadid-Pecht et al. already deals with noise
cancellation.

The Examiner has also relied on the Hurwitz et al.
patent as allegedly disclosing the invention as claimed.
However, Applicants maintain that the Examiner has

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misinterpreted the cited reference. Specifically, Applicants
refer to the disclosure relied upon by the Examiner at column
8, lines 50-64 of Hurwitz et al.:

> constant reference voltages V6 and V7 (which may be
> the same voltage or different voltages) are applied
> respectively to the second terminals 36,34 of the
> two capacitors C5, C6, switch S6 is closed and
> switch S7 is opened and the pixel array is exposed
> to an incoming image so that (once switch S6 is re-
> opened) a combined pixel output signal, comprising
> an image signal Vsig to be detected and an offset
> signal Voff-Vreset, stored in C5. Switch S7 is
> subsequently closed and the pixel 2 is reset. The
> signal stored on C5 is Vreset-Vsig-Voff while the
> resultant signal stored on C6 is Vreset-Voff. The
> potential difference between the two capacitors is
> thus equal to Vsig, the signal to be detected.

As should be clear from a careful reading of this
portion of Hurwitz et al., there is no teaching of: obtaining
a first image by subtracting the preliminary output, obtained
after a reset, from first output; obtaining a second image by
subtracting the preliminary output from second output; and
combining pixels from first and second images to obtain a
final image with increased dynamic range. Indeed, in column 9,
lines 1-23 of Hurwitz et al., it is taught that Vsig is
obtained using a ramp counter 44 that generates and broadcasts
a digital ramp count corresponding to the analog voltage ramp
Vr, across all the pixel columns 4. The latch 46 communicates
with the ramp counter 44 via the output bus 42, and with the
ramp voltage source, so that the value of the digital count is
latched at the switching point of the comparator 40 the
instant that the ramp voltage Vr=Vsig. The latched digital
count provides a digital fixed-offset-corrected pixel output
which may be read directly at an output of the image sensor 1.

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     As the Examiner is aware, a claim is anticipated
only if each and every element as set forth in the claim is
found, either expressly or inherently described, in a single
prior art reference. The identical invention must be shown in
as complete detail as is contained in the claim.

     As discussed in the previous response, in Dierickx
et al., sample A is obtained after a relatively short period
of time, and so that image data represented by sample A is
sensitive to high intensity light. This charge is then stored
on a memory element provided as a specialized part of each
pixel. Charge then continues to be built up on the photodiode
and then sample B is taken at the end of the integration
period. This charge packet contains the charge that has been
accumulated since the time of sample A up until the time of
sample B. Because this time is longer than the time from the
start of the integration period until the time of sample A,
sample B represents an image which is relatively sensitive to
low intensity light. The two signals are then combined to form
a resultant read-out image.

     In contrast, a first output of the present invention
reads the signal that has been accumulated from the beginning
of the cycle to the read point without destroying, that is
transferring, the cumulative charge. The second output that is
read also reads the cumulative charge that has built up from
the beginning of the integration cycle including the charge
read out in the first signal. The first output and the second
output are then combined to obtain a resultant set of image
data having a dynamic range different from the first and
second dynamic ranges. This does not require the presence of a

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dedicated memory element for each pixel as is seen in Dierickx
et al. patent.

  Accordingly, the Dierickx et al. patent adds nothing
to the deficiencies of Yadid-Pecht et al. or Hurwitz et al. As
the Examiner is aware, to establish a prima facie
case of obviousness, three basic criteria must be met. First,
there must be some suggestion or motivation, either in the
reference itself or in the knowledge generally available to
one of ordinary skill in the art, to modify the reference.
Second, there must be a reasonable expectation of success.
Finally, the prior art reference must teach or suggest all the
claim features. The initial burden is on the Examiner to
provide some suggestion of the desirability of doing what the
Applicants have done. To support the conclusion that the
claimed invention is directed to obvious subject matter,
either the reference must expressly or impliedly suggest the
claimed invention or the Examiner must present a convincing
line of reasoning as to why the artisan would have found the
claimed invention to have been obvious in light of the
teachings of the reference. Both the suggestion to make the
claimed combination and the reasonable expectation of success
must be founded in the prior art and not in Applicants'
disclosure.

  There is simply no teaching or suggestion in the
cited references to provide the combination of features as
claimed. Accordingly, for at least the reasons given above,
Applicants maintain that the cited references do not disclose
or fairly suggest the invention as set forth in Claims 32 and
36. Furthermore, no proper modification of the teachings of
these references could result in the invention as claimed.

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Thus, the rejections under 35 U.S.C. §102 and §103 should be withdrawn.

It is submitted that the independent claims are patentable over the prior art. In view of the patentability of the independent claims, it is submitted that their dependent claims, which recite yet further distinguishing features are also patentable over the cited references for at least the reasons set forth above. Accordingly, these dependent claims require no further discussion herein.

IV. CONCLUSION

In view of the amendments to the claims and the arguments provided herein, it is submitted that all the claims are patentable. Accordingly, a Notice of Allowance is requested in due course. Should any minor informalities need to be addressed, the Examiner is encouraged to contact the undersigned attorney at the telephone number listed below.

Respectfully submitted,

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CERTIFICATE OF FACSIMILE TRANSMISSION

I HEREBY CERTIFY that the foregoing correspondence has been forwarded via facsimile number 571-273-8300 to the Commissioner of Patents this 15th day of March, 2006.

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